

NATIONAL UNIVERSITY



Third Year Syllabus Department of Zoology

Four Year B.Sc. Honours Course
Effective from the Session: 2013–2014

National University
Syllabus for Four Year B.Sc. Honours Course
Subject: Zoology
Effective from the Session: 2013-2014
Year-wise Papers and marks distribution

THIRD YEAR

Paper Code	Paper Title	Marks	Credits
233101	Evolution, Palaeontology and Zoogeography	100	4
233103	Ecology	100	4
233105	Genetics and Animal Breeding	100	4
233107	Developmental Biology and Ethology	100	4
233109	Human Physiology	100	4
233111	Systematics, Demography and Family Planning	100	4
233113	Cell and Molecular Biology	100	4
233114	Zoology Practical-III	100	4
	Total =	800	32

Detailed Syllabus

Paper Code	233101	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Evolution, Palaeontology and Zoogeography			

Evolution

1. Lamarckism, Darwinism, Wallace's theory and synthetic theory.
2. Evidences of organic evolution: Biogeography, comparative anatomy, physiology, embryology, palaeontology and genetics.
3. Modern trends in evolutionary thoughts: Punctuated equilibrium.
4. Speciation: Definition, sympatric and allopatric speciation including induced speciation.
5. Rates and mechanism of evolution: Isolation, continuous and discontinuous variations, gene mutation and chromosomal aberrations.
6. Convergent, divergent and parallel evolution.

Palaeontology

1. Introduction to palaeontology.
2. Types of fossils, process of fossilization, fossil dating methods, significance of fossils.
3. Geological Time Scale: Major events in different stages.
4. Palaeontological history of horse, camel, elephant and man.

Zoogeography

1. Introduction to Zoogeography.
2. History of the distribution of the land and water bodies of the world, Laurasia and Gondwana land, continental drift theory, land bridge.
3. Zoogeographical Regions and sub-regions of the world, their boundaries, physical characteristics, climatic conditions, vegetation and fauna.
4. Glaciation and its influence in the distribution of animals.
5. Insular fauna.
6. Origin, evolution and pattern of diagnostic characteristic fauna of different regions with special reference to the tropical and sub-tropical zones.

Books Recommended:

1. M.R. Rose and V.V. Lauder. 1996. *Adaptation*. Academic Press
2. R.N. Brandon. 1995. *Adaptation and Environment*. Princeton UP, USA
3. G.C. Williams. 1996. *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought*. Princeton UP, USA
4. S. Stearus and R. Hoeksra. 2000. *Evolution: An Introduction*. OUP, USA
5. C. Patterson. 1999 *Evolution*, Natural History Museum, London
6. C. Nielsen. 1995. *Animal Evolution: Interrelationships of the Living Phyla*. OUP
7. G. Bell. 1996. *Selection: The Mechanism of Evolution*. Chapman & Hall
8. S. Bengtson. 1995. *Early Life on Earth*. Columbia UP, USA

9. J.D. Bernal. 1969. *The Origin of Life*. Weidenfeld and Nicolson, London
10. P.J. Darlington. 1998. *Zoogeography: The Geographical Distribution of Animals*. Krieger, USA

Paper Code	233103	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Ecology			

1. Introduction

- a) Definition
- b) History and scope of ecology
- c) Study of ecology: Theoretical and practical approaches
- d) Branches of ecology

2. The Environment

- a) Abiotic factors: Temperature, relative humidity, pH, radiation, water, atmospheric gases, light, biogenic salts, current and pressure.
- b) Biotic factors: Positive and negative interactions (protocooperation, commensalisms, mutualism, competition, predation, parasitism).

3. Ecosystem Ecology

- a) Definition, structure, component and function of ecosystem
- b) Energy and its flow in ecosystem.
- c) Biogeochemical cycles: Carbon, nitrogen and carbon dioxide
- d) Aquatic ecosystems: Pond, lake, river, estuary and marine
- e) Terrestrial ecosystems

4. Community Ecology

- a) Definition and types of communities
- b) Community concept and analysis
- c) Community structure, composition and stratification
- d) Ecological niche and habitats
- e) Ecological succession, ecotone
- f) Concept of climax
- g) Biomes and its types

Books Recommended

1. R.E. Ricklefs. 1990. *Ecology*. W.H. Freeman
2. R.L. Smith. 1998. *Elements of Ecology*. Longman
3. R. Putman. 1993. *Community Ecology*. Chapman & Hall
4. M.Begon, J.L. Harper and C.R. Townsend. 1996. *Ecology: Individuals. Populations and Communities*. Blackwell Science.
5. S.I. Chapman and M.J. Reiss. *Ecology: Principles and Application*. CUP
6. J.L. Chapman and M.J. Reiss. *Ecology: Principles and Applications*. CUP
7. C.J. Krebs. 1993. *Ecology- The Experimental Analysis of Distribution and Abundance*. Harper Collians, New York
8. E.P. Odum. *Fundamentals of Ecology*, Saunders, Philadelphia

9. C.J. Krebs. 1998. *Ecological Methodology*. Addison Wesley Longman
10. P.J. Morin. 1999. *Community Ecology*. Blackwell Science

Paper Code	233105	Marks: 100	Credits: 4	Class Hours: 60
Paper Title:	Genetics and Animal Breeding			

1. Introduction to genetics, history of genetics.
2. Mendel's principles of segregation of gene and of independent assortment.
3. Simple Mendelian traits in man.
4. Modification of Mendelian ratio.
5. Epistasis and reversion.
6. Test cross and back cross.
7. Multiple alleles and pseudoalleles.
8. Pleiotropism.
9. Penetrance and expressivity.
10. Linkage and crossing over.
11. Sex-linked, sex-limited and sex-influenced traits.
12. Mutation and chromosomal aberrations.
13. Sex determination.
14. Cytoplasmic inheritance.
15. Population genetics: Hardy-Weinberg law, factors affecting the Hardy-Weinberg Law, mutation, migration and genetic drift.
16. Chromosomal mapping.
17. Concepts of eugenics.
18. Animal breeding: Inbreeding, outbreeding and crossbreeding, and their application to economically important animals.
19. Role of genetics in human welfare.

Books Recommended

1. D.L. Harlt and E.W. Jones. 1998 *Genetics: Principles and Analysis* Jones and Bartlett
2. E.W. Sinnott, L.C. Dunn and DobZhansky. *Principles of Genetics*. McGraw Hill Book Co. New York
3. A.S. Islam, *Fundamentals of Genetics* Vikas publishing House Pvt. Ltd.
4. R.F. Weaver and P.W. Hedrick. 1995. *Basic Genetics*. Wm. C. Brown Publisher, Dubuque, Iowa
5. M.R. Cummings. 1997. *Concepts of Genetics* Prentice Hall
6. J.D. Hawkins. 1996. *Gene Structure and Expression*. CUP
7. M.J. Kearsey and H.S. Pooni. 1996. *The Genetic Analysis of Quantitative Traits*. Chapman & Hall
8. T.A. Brown. 1997 *Genetics: A Molecular Approach*. Chapman and Hall

9. J.M. Walker and E.B. Gingold. *Molecular Biology and Biotechnology*
10. C. Stern. *Principles of Human Genetics* W.H. Freeman & Co. San Francisco

Paper Code	233107	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Developmental Biology and Ethology			

Developmental Biology (50 marks)

1. Gametogenesis: Spermatogenesis and oogenesis in mammals.
2. Morphology of mammalian eggs and sperms.
3. Types of eggs and sperms in animals.
4. Fertilization in mammals: Types, events in fertilization, cortical changes, chemistry of fertilization, significance of fertilization.
5. Cleavage and cleavage types in animals.
6. Formation of morula, blastula and gastrula in *Branchiostoma*, toad and chicken.
7. Formation and fate of germinal layers in *Branchiostoma*, toad and chicken.
8. Extra embryonic membranes in amniotes.
9. Placentation in mammals.
10. Development of *Neanthes* and man.

Ethology (50 Marks)

1. **Introduction**
 - a) Definitions
 - b) Concepts of behaviour
2. **Development of behaviour**
 - a) Ontogeny
 - b) Natural selection
 - c) Environmental influence upon behaviour
3. **Physical basis of behaviour**
 - a) Neural control of behaviour
 - b) Reflexes and behaviour
 - c) Effects of hormones on sexual, aggressive and maternal behaviour.
4. **Instinct and learning**
 - a) Introduction to instinct and learning behaviour
 - b) Imprinting and learning
 - c) Sensitive period
5. **Social behaviour**
 - a) Altruism: Kin selection, mutualism, reciprocity
 - b) Parental care
6. **Signals for communication**
 - a) Types and functions of communication
 - b) Animal calls and their uses

Books Recommended

1. S.F. Gilbert and A.M. Raunio (Editors), 1997 *Embryology, Constricting the Organism*, Sinauer
2. B.I. Balinsky An Introduction of Embryology,
3. B.H. Willer and J.M. Oppenheimer 1968 *Foundation of Experimental Embryology* Prentice-Hall of India Pvt. Ltd. New Delhi.
4. J.S. Rosenblatt and C.T. Snowdon (Editors). 1996. *Parental Care. Evolution. Mechanisms and Adaptive Significance*
5. Alcock. 1998. *Animal Behaviour*. Sinauer.

6. J.R. Krebs and N.B. Davis 1993. *An Introduction to Behavioural Ecology*. Blackwell Scientific Publications.
7. A Manning and M. Dawkins 1998. *Introduction to Animal Behaviour*. Cambridge University Press, Cambridge, UK.
8. R. Mathur 1996. *Animal Behaviour*. Rastogi and Company, India.
9. D. McFarland. 1998. *Animal Behaviour: Psychobiology, Ethology and Evolution*, Prentice Hall, London.
10. J. Alcock. 1998. *Animal Behaviour*. Sinauer.
11. J.R. Krebs and N.B. Davies 1993. *An Introduction to Behavioural Ecology*. Blackwell Scientific Publications.
12. A. Manning and M. Dawkins 1998. *Introduction to Animal Behaviour*. Cambridge University Press, Cambridge, UK.
13. R. Mathur 1996. *Animal Behaviour*. Rastogi and Company, India.
14. D. McFarland 1998. *Animal Behaviour: Psychobiology, Ethology and Evolution*. Prentice Hall, London.

Paper Code	233109	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Human Physiology			

1. **Digestion:** Definition; composition and functions of saliva, digestive juices, enzymes and biles; absorption of different types of food in intestine, functions of liver and pancreas.
2. **Food and nutrition:** Definition, structure and function of different types of food, their nutrition with special reference to carbohydrates, lipids, proteins and vitamins.
3. **Metabolism:** Definition, metabolic pathways, metabolism of carbohydrates (glycolysis, Kreb's Cycle and oxidative phosphorylation), metabolism of glycogen in liver and muscles (glycogenesis and glycconeogenesis), metabolism of lipids (deposited fats and its functions, oxidation of fats), metabolism of proteins (fate and functions of amino acids, Ornithine Cycle, transamination-transmethylation); role of endocrine glands, vitamins, phospholipids, steroids and cholesterol.
4. **Circulation :** Myogenic regulation of heart beat, transmission of impulse, cardiac cycle, functions of blood, blood grouping, blood pressure, mechanism of coronary and pulmonary circulations, functions of tissue fluids and lymph.
5. **Respiration:** Mechanism of breathing, pulmonary ventilation, exchange of gases in lungs, oxygen and carbon dioxide transport, internal respiration.
6. **Movement:** Mechanism of muscle contraction and retraction, neuromuscular junction, metabolism in muscles, muscular fatigue.
7. **Coordination (neural and hormonal):** Conduction of nerve impulse, reflex action, hormonal control.
8. **Excretion:** Formation of urine in kidneys (ultrafiltration, reabsorption and secretion), osmoregulation, regulation of blood pH, composition of urine.
9. **Homeostasis:** Definition, mechanism and role of various physiological systems in homeostasis. Negative feedback mechanism.

Books Recommended

1. C.C. Chatterjee. *Human Physiology: Vols. I & II*
2. V. Tatornor. *Human Anatomy and Physiology*.

Paper Code	233111	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Systematics, Demography and Family Planning			

Systematics (50 marks)

1. Introduction to taxonomy and systematics
2. History of taxonomy
3. Old and new systematics
4. Levels of taxonomy
5. Taxonomic categories
6. Species concept
7. Methods of animal collection and preservation for taxonomic studies
8. Taxonomic publications
9. Taxonomic keys: Types, preparation and significance
10. International Code of Zoological Nomenclature (ICZN), origin of the code, rules of nomenclature
11. Law of priority
12. Type specimens
13. Modern trend in taxonomic approach including cladistic
14. Formation of generic and specific names
15. Describing a new species

Demography and Family planning (50 marks)

1. Introduction, definition and history of demographic development
2. History and perspective of human population growth
3. Human population and its nature of growth
4. Factors for population explosion
5. Population management
6. Demographic theories
7. Logistic model of population growth
8. Density dependent and density independent factors
9. Absolute and relative growth rates
10. Human reproductive system and the accessory glands
11. Sex hormones and their role in human reproduction, puberty, ovarian cycle, menopause
12. Regulation menstrual cycle and pregnancy
13. Fertilization, pregnancy, placenta, fetus and fetal development, parturition (child birth)
14. Importance of family planning and management, ethics of family planning
15. Birth control principles and methods

Books Recommended

1. G.G. Simpson. 1990. *Principles of Animal Taxonomy*. Columbia UP, USA
2. E. Mayr and P.D. Ashock. 1997. *Principles of Systematic Zoology* McGraw Hill
3. E. Mayr. 1999 *Systematics and the Origin of Species from the view point of a Zoologist*. Harvard UP. USA
4. Q.D. Wheeler and R. Meier (Editors). 2000 *Species Concepts and Phylogenetic Theory: A Debate*. Columbia UP. USA
5. A.F. Gotch. 1995. *Latin Names Explained: A Guide to the Scientific Classification of Reptiles. Birds and Mammals*. Blanford

6. W.D.L. Ride et al. (Editors). 1999. *International Code of Zoological Nomenclature ICZN*
7. D.A. Dunnette and R.J. O. Brien (Editors). 1992. *The Science of Global Change: The Impact of Human Activity on the Environment*. RSC
8. A Goudie. 1993. *The Human Impact on the Natural Environment*. Blackwell Science
9. N.T. Boaz and A.J. Almquest. 1996. *Biological Anthoropology: A Synthetic Approach to human Evolution*, Princeton- Hall
10. R.K. Wolke. *Impact: Science on Society*, W.B. Saunders Company, London.

Paper Code	233113	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Cell and Molecular Biology			

Cell Biology (50 marks)

1. Microscope: Types, functions, magnification and resolving power
2. General account of the cell: Structure of cell, prokaryote and eukaryote cells, protoplasm and its colloidal nature, organic compounds in cells, cell theory
3. Cellular structure and functions: Chemical composition of cell membrane, membrane models and functions of cell membrane; types, structures and functions of chromosomes.
4. Cellular organelles: Ultrastructure, formation and functions of Golgi complex, endoplasmic reticulum, ribosomes, lysosomes, mitochondria, centrioles, microtubules and cytoskeleton; morphology and cytochemistry of nucleus
5. Changes in chromosomal structures and numbers: Deletion, duplication, inversion, translocation, aneuploidy, euploidy and their significance
6. Cell division: Types of cell division, growth cycle, division and differentiation, significance of cell division.

Molecular Biology (50 marks)

1. Concepts of molecular biology
2. Gene: Chemistry and functions of nucleic acids (DNA and RNA)
3. Replication of DNA, transcription of RNA, replication of viruses
4. Genetic organization of DNA and RNA: Genome and genomics
5. Protein synthesis and its regulation
6. Immunology: Molecular biology of immune systems, structure and functions of immunoglobulins, antibody, antibody synthesis, immunization

Books Recommended

1. M.T. Peleazar. R.D. Reid and E.C.S. Chan. *Microbiology*: Tata McGraw Hill Co
2. H.G. Schlegel. 1993. *General Microbiology*. CUP
3. S. O'Neill. A.A. Hoffmann and J.H. Werren (Editors). 1997. *Influentia Passengers: Inherited Microorganisms and Arthropod Reproduction*. OUP
4. A.H. Varnam and M.G. Evans. 1998. *Environmental Microbiology* Manson

5. A. Bruce D. Brey and J.D. Watson 1994. *Molecular Biology of the Cell*. (3rd Ed.) Garland Publ. Inc.
6. G.S. Stent and R. Calender. 1971. *Molecular Genetics* W.H. Freeman and Company. San Fransisco.
7. E.D. Robertis and E.M. De Robertis. Jr. 1981. *Essentials of Cell and Molecular Biology*. Saunders College Publishing. New York
8. P.S. Verma and V.K. Agarwal 1985. *Cytology*. S. Chand & Co. Ltd, New Delhi, India.
9. G. Chopra, R.C. Gupta, S.K. Goyal 1989. *Cytology*. S. Chand & Co Ltd. New Delhi, India.
10. D. Robertis 1995. *Cell and Molecular Biology*. B.I. Waverly Pvt. Ltd., New Delhi, India

Paper Code	233114	Marks: 100	Credits: 4	Time: 2 days, 6 hours/day
Paper Title:	Zoology Practical-III			

1. **Microtomy:** Preparation of permanent histological slides.
2. **Taxonomy:** Taxonomic study of different animal groups following standard taxonomic procedures and techniques.
3. **Ecology:**
 - a) Visiting pond to study pond ecosystem including faunal and floral composition and food chain.
 - b) Visiting forest and sea shore to study animals and their adaptation, and preparation of a report on the visits.
 - c) Study of the population of a species in a given area by using quadrat/transect method.
4. **Water analysis:** Measurement of dissolved oxygen, carbon dioxide, ammonia, nitrite, pH, turbidity and salinity.
5. **Genetics:** Study of the characteristics of *Drosophila*, its identification of body parts and sex, identification of mutant flies.
6. **Physiology:** Estimation of blood pressure and pulse rate, determination of blood group, estimation of blood sugar.
7. **Animal preservation:** Collection, handling, immobilization, killing and preservation of different animal groups following standard techniques.
8. **Excursion/study tour to the sea/estuary/forest, specimen collection, and preparation of a report.**
9. **Preparation of practical class note books.**

Distribution of marks for Third Year Final Practical Examination

Microtomy

= 25 marks

(Block preparation - 5, tissue section - 4, tissue stretching - 5, tissue staining - 4, tissue identification - 2, drawing and labelling - 3, identifying characteristics - 2)

1. Taxonomy

= 10 marks

- (Construction of a dichotomous taxonomic key on the specimens - at least 10 specimens)
2. **Ecology** = 10 marks
 3. **Water Analysis** = 10 marks
(One item will be given in the examination and the following points will be mentioned -
Principles and objectives - 2, materials required - 1,
procedure - 2, data taking and presentation - 1,
data analysis and discussion - 4)
 4. **Genetics** = 10 marks
 5. **Physiology** = 10 marks
 6. **Excursion report and collection** = 15 marks
(Collection, preservation and identification of 5 specimens
of different phyla, excursion report: Collection – 5, Report- 10)
 8. **Practical class note books** = 10 marks
- Total = 100 marks**

Books Recommended

1. J.R. Baker. 1996. *Cytological Technique*. John Wiley & sons
2. J.E. Brower, J.H. Zar and C.N. von Ende (Editors). 1997. *Field and Laboratory Methods for General Ecology*. Wm. C. Brown
3. S.D. Wratten and G.L.A. Fry *Field and Laboratory Exercises in Ecology*. Edward Arnold, London
4. T.A. Brown. 1994. *DNA Sequencing: The Basics*. BIOS
5. D.B. Roberts (Editor). 1998. *Drosophila: A Practical Approach*. IRL Press
6. W.A. Becker. 1992. *Manual of Quantitative Genetics*.